State of California
The Resources Agency
Department of Fish and Wildlife

2013 Breeding Season Monitoring Results for California Least Tern, *Sternula antillarum browni*, at the Bolsa Chica Ecological Reserve

by

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30 August 2013

INTRODUCTION

The goal of this report is to describe breeding season results for California least tern (*Sternula antillarum browni*) at the Bolsa Chica Ecological Reserve (BCER) as well as management actions taken by Department of Fish and Wildlife staff during 2013; and, to provide management recommendations for 2014.

BCER is located in Huntington Beach in Orange County, California. BCER is a coastal estuary with a number of different habitats including open water, mudflats, salt marsh, coastal dunes, seabird nesting islands, and freshwater marsh. The 554-ha (1,369ac) reserve is bordered on the north by Warner Avenue, on the west by Pacific Coast Highway (PCH) and the Bolsa Chica State Beach, on the south by Seapoint Avenue, and on the east by residential neighborhoods. The Department of Fish and Wildlife (Department) operates a small field office on the reserve located at 17783 Graham Street.

There are five seabird nesting sites at BCER: Two islands within Bolsa Bay known as North and South Tern Island, respectively; and three nesting areas within the Bolsa Chica lowlands: Nest Sites 1-3 (Figure 1). During 2013, California least terns (LETE) nested on Nest Sites 1-3 and South Tern Island (STI).

Figure 1. Seabird nesting sites at Bolsa Chica Ecological Reserve in Orange County. North Tern Island (NTI) and South Tern Island (STI) are in Inner Bolsa Bay, a muted tidal estuary. Nest Sties 1-3 (NS1, NS2, NS3) surround the Full Tidal Basin and are part of a restoration project completed August, 2006.

LETE share NS1-NS3 and STI with western snowy plover (*Charadrius alexandrinus nivosus*). Because North Tern Island (NTI) is used by large terns, LETE and plover nests, when initiated on NTI, are later abandoned. Three large tern species migrate to BCER annually to breed. These species include elegant tern (*Thalasseus elegans*) which breeds on NTI in large numbers and is listed internationally as Near Threatened (IUCN); and Caspian tern (*Hydroprogne caspia*) and royal tern (*Thalasseus maximus*) which each breed on NTI in relatively small numbers (<100 pairs). Over the years, the black skimmer (*Rynchops niger*), a California Species of Special Concern, has nested on NTI, STI, and NS1.

Forster's terns (*Sterna forsteri*) nest on the pickleweed (*Salicornia spp.*) that grows on the western perimeter of NTI and within Bolsa Bay. Four other tern species have been observed at BCER, but do not breed here: the gull-billed tern (*Gelochelidon nilotica*) – another California species of Special Concern and a candidate for Federal Listing; the sooty tern (*Onychoprion fuscatus*); the common tern (*Sterna hirundo*); and, the black tern (*Chlidonias niger*).

Department staff record observations of large terns and skimmers throughout the breeding season. When these larger birds establish colonies on NS1, impacts to LETE and snowy plover (SNPL) may occur due to interspecies competition for nesting space. No large terns or skimmers nested on NS1 during 2013.

By 19 March, we began seeing the first elegant (ELTE) and Caspian tern (CATE) arrivals loafing on the sand bar and mudflats of the FTB. By 19 April, ELTE numbered 550-600 and the population of Forester terns (FOTE) had increased to approximately 200. CATE numbered well below 100.

Black skimmers (BLSK) arrived in early May and had begun nesting on NTI by 4 June, when 150 nests were counted. Also on this date, 2 royal tern (ROTE), 61 CATE, and 617 ELTE nests were counted on NS1. By 18 June, BLSK nests numbered 443 and chicks of all 4 species were seen on NTI.

On 17 July, a second wave of 87 BLSK nests was counted on NTI. CATE chicks numbered 25 and the estimate for ELTE chicks was 400-500. The 2013 pair estimate for BLSK was 530, which may be a record.

On 19 July, a 23-year-old BLSK was seen on NTI by C. Collins and P. Knapp who were reading service bands that day. The skimmer was banded at Bolsa Chica in 1990. According to Dr. Collins, this is the oldest BLSK on record.

On 14 August, counts of terns on NTI yielded 300 adult ELTE with 175-200 older chicks; 215 adult BLSK with 20 near fledgling chicks; 7 adult CATE with 4 large chicks, and 5 adult ROTE with chicks. By 29 August, only 20-25 ELTE (adults and young), 20 juvenile BLSK, and 2 young CATE remained on NTI. Throughout August, the FTB mudflats were covered with the season's ELTE fledglings.

METHODS

Site Preparation

Each of the five nest sites on the reserve (Figure 1) were prepared for the season by CDFW staff and volunteers. This work was conducted September 2012 through January 2013. Methods included treating non-native vegetation with herbicides and manually removing non-native plants from each nest site. Overall, the goal was to have not more than 20% vegetative cover so as to leave enough open space for nesting. In addition, an extensive refurbishing of NS1 was accomplished with contractors and heavy machinery ($118,000 expense). Weeds were mechanically removed; the surface of the site was scarified and then covered with clean beach sand sourced from the inlet of the Full Tidal Basin.

To further prepare for the nesting season, fencing at NS1 was extended at the ends and a fence was installed around the entire perimeter of NS3. This was done to protect the sites from mammalian predators such as coyote. All new fencing matches fence installed during the 2004-2006 restoration project (1.8m-high rubber-coated chain-link topped with 3 strands of barbed wire). The new nest site fencing described here was donated by two NGOs: The Amigos de Bolsa Chica and the Bolsa Chica Conservancy, saving the state roughly $80,000.

In an effort to standardize LETE monitoring methods within and between all Department-managed reserves, the grid size on all nesting sites within the South Coast Region was changed to 20m X 20m ($400m^2$). The four BCER sites used by LETE were updated to this new standard prior to the beginning of the 2013 breeding season.

Because each of BCER's nest sites has different surface areas and shapes, the number of grids on each site varies. The surface area of STI is 0.46ha; NS1 is 6.0ha; NS2 is 0.48ha and the area of NS3 is 1.28ha. The surface areas reported here are for usable nesting habitat and do not include edges or slopes that normally would not support nesting.

Since NTI is used by large tern species and not LETE, there is no grid system installed on that island. Nonetheless, the usable nesting habitat on that site is 0.77ha.

Clay roof tiles were used as potential chick refugia on STI (n=55), NS1 (n=40), NS2 (n=2), and NS3 (n=4). On the north end of NS1, the tiles were painted black and white and arranged so as to assist Eyes On Nest Site (EONS) volunteers in the identification of nest locations.

Monitoring

The monitoring method used on Nest Sites 1-3 and STI is categorized as Type 1: Monitors entered the colony weekly to mark nests and record the number of eggs and chicks observed during each visit. Monitors also recorded any evidence of disturbance such as predation. Each nest was marked with a pair of numbered tongue depressors (Figure 2).

When a nest appeared to be unattended by adult LETE, the egg or eggs were turned up in the nest and an up arrow (↑) was recorded next the nest

number on the data sheet. If the egg(s) remained up for three consecutive monitoring visits, the nest was record as “A” for abandoned. Once eggs are known to be abandoned, they are usually buried so as not to attract predator species. This season, two-dozen abandoned LETE eggs were collected for the Bight ’13 Avian Egg Study and given to a USFWS biologist for heavy metal and isotope analysis.

As mentioned above, each nesting site has a number-letter grid system used to identify the location of individual nests.

In addition to weekly monitoring visits, NS1, NS3, and STI were monitored daily from a vehicle using binoculars and NS2 was monitored daily from the nearest levee using a spotting scope.

At least weakly, NTI was checked from a distance using a spotting scope (Type 2 method). No LETE nests were initiated on NTI.

Figure 2a & 2b. California least tern nests marked with numbered tongue depressors. Photos by Connie Boardman (left) and Ross Griswold (right).

The number of breeding pair was estimated by using actual counts of birds as nests were initiated. The fledgling count reported for 2013 was based on field observations made by the primary monitor. Because LETE fledglings may leave Bolsa Chica within hours or days of fledging and are not banded, accurate fledgling counts are difficult, if not impossible, to estimate.

Predator Management

Due to the high number of predator species at BCER and the level of mortality they can inflict upon least tern as well as western snowy plover, predator control is an essential management tool for the recovery of these species’ populations. The goal of predator management is to identify species known to prey upon least tern and plover eggs, chicks, and adults and prevent mortality by those predators during the breeding season. At Bolsa Chica, at least 20 species are known or suspected predators of LETE.

CDFW employs a predator management specialist, Wally Ross, who patrolled BCER between January and August, 2013. During his visits, W. Ross noted the activities of least tern and plover, predator species and or their tracks and scat.

Other staff used additional means of predator control and these included patching holes dug underneath the perimeter fence to prevent encroachment from domestic pets from neighboring housing tracts and shooing predators away from nesting areas.

RESULTS AND DISCUSSION

Monitors

During the 2013 breeding season, LETE activity was monitored primarily by Peter Knapp. Knapp was assisted by Kelly O'Reilly, Ross Griswold, Charles Collins, and Gary Keller.

Chronology

LETE arrived on 12 April and by the end of the month, they were flying around STI and Nest Sites 1-3. The first nest of the season was found on STI on 8 May (Knapp, pers. obsv.). The last nest of the season was found 9 July on NS2; by 23 July we determined it to be abandoned. Hatching was recorded 1 June (STI) through 9 July (NS2). Bolsa Chica had no second wave of nesting. The first fledgling was recorded during June on STI (Knapp, pers. obsv.). The last least terns of the 2013 season were observed foraging in the NE corner of the Full Tidal Basin on 9 August (O'Reilly, pers. obsv.).

Data Summary

South Tern Island

LETE were active on South Tern Island (STI) from early May until the first week of July, 2013. Based on daily observations from the levee next to the island, we know that the first nest was initiated on 8 May. Weekly monitoring visits to the island occurred between 14 May when 17 nests were found, and 9 July when the final 23 nests were determined to be either abandoned (n=11) or depredated (n=12).

During the season, a total of 84 nests were initiated on STI (Table 1). Monitors confirmed 25 nests hatched, producing 40 chicks. Seven nests were recorded as probable hatches (PH), hypothetically producing an additional 10 chicks for a grand total of 50 chicks for the site. Nearly 100% of these chicks were taken during the first week of life by predators that did not leave tracks. Only 4 dead chicks were found on STI during the season; all were less than a week old and apparently died of natural causes.

Despite daily, and sometimes twice daily, observations of the STI least tern colony from the levee, direct take of a chick was never observed. However, due to numerous sightings of a red-tail hawk (*Buteo jamaicensis*) (RTHA) seen perched near STI and a male northern harrier (*Circus cyaneus*) (NOHA) flying

over it, we strongly suspect that these two raptors were responsible for most chick mortality there. For example, on 9 May, a large RTHA was seen perched on the levee next to STI, being stooped by LETE from the colony (O'Reilly pers. obsv.). Further, we assume that continuous pressure from avian predators was the reason for nest abandonment. The abandoned eggs were later scavenged by ravens (confirmed by raven tracks all over the site). On 16 June, the remains of an adult LETE were found on the island (Knapp, pers. obsv.).

Over the season, 56% (n=37) of the nests on STI were abandoned, 13 nests with eggs were depredated, and the fate of two nests was recorded as unknown. Only one fledgling was observed on STI. In contrast, 15 fledglings were produced on STI last year, and that was with 33% fewer nests (n=56).

Nest Site 1

Weekly monitoring visits to Nest Site 1 (NS1) began 21 May and concluded on 6 June. During this brief period, only 20 nests were found with a total of 29 eggs. All nests were lost to depredation attributed to gulls, based on gull tracks over a large area of the site. The complete reproductive failure of LETE on NS1 was quite unexpected for two reasons: First, the site had been resurfaced with beach sand and was free of weeds and therefore in excellent condition for the birds. Second, high numbers of LETE had nested on this site in the past (176 nests in 2012). Apparently, LETE were driven off NS1 by flocks of gulls that used the site for loafing. The gulls also impacted western snowy plover (SNPL) productivity on NS1 this year. All but 2 of the 14 SNPL nests on NS1 failed to produce fledglings and gulls were suspected in most of the mortality there.

Nest Site 2

Weekly monitoring visits to Nest Site 2 (NS2) began 16 May and concluded on 23 July. During this period, 50 nests were found on the site and 23 nests were confirmed hatches that produced 37 live chicks. Twenty-two nests were recorded as probable hatches (PH), hypothetically producing an additional 32 chicks for a grand total of 69 chicks for the site. Only four dead chicks were found on the site during the monitoring period and only one egg was depredated: nest #49 found pecked on 9 July with a Corvid track near it.

In addition to the low mortality observed, we consistently saw live chicks ("runners") on the site during repeated monitoring visits and we observed fledglings from this site June through August. It is worth noting that NS2 is within sight of the CDFW office; thus, CDFW staff and volunteers would know if predators were near the sight. Given all of these facts, we believe 34 fledglings from NS2 is a reasonable and conservative minimum estimate [1 confirmed fledgling + 37 confirmed live chicks - 4 dead chicks]; especially since there were potentially more chicks born than we were able to confirm (n=32). The maximum fledgling estimate from NS2 is 66.

With respect to productivity, 2013 was the second best year on record for NS2. Last year (2012), 46 LETE nests were initiated on this site; however, due to coyote predation, none of the 53 chicks produced survived to fledge. In 2011, we

estimated 51 to 72 LETE fledged from NS2; that is the highest productivity since LETE began using the site in 2010.

Nest Site 3

Due to exceptionally low LETE activity on Nest Site 3 (NS3), this site was only monitored for three weeks: 30 May – 13 June. During that period, only three 1-egg nests were found and they were subsequently depredated (Corvids suspected). On 30 May, a partially eaten adult least tern was found on the site; its head and chest cavity were missing. During the brief period that LETE were seen courting on NS3, a male NOHA was observed in the vicinity on numerous occasions. Corvids were also often seen on NS3 but attempts to trap them were unsuccessful. Although we knew Corvids would continue to be a problem on NS3, we had hoped for higher LETE productivity on the site during 2013 since it is now protected from coyote and other mammals.

During 2012, a total of 27 LETE nests were initiated on NS3 but 100% of them were depredated by coyote and raven. Coyote predation was also problematic during 2011, so funding was sought to construct a fence around NS3. During the winter of 2012, two non-profit organizations donated the funds needed to construct a fence around NS3 as well as increase fencing at NS1.

Bolsa Chica Overall

The reserve-wide nest total was 157; a 48% decrease from last year when we had 305 nests (Figure 3). Despite the small number of nests, our fledgling estimate of 35-67 (Table 1 and Figure 4) represents a 53%-76% increase over 2012 when only 16 LETE fledged from BCER. Because we saw no evidence of a second wave or re-nesting, we estimate the number of breeding pair was 157 (Figure 5).

The breeding success we saw in 2013 is owed to the fact that predators mostly ignored NS2 which produced all but 1 of this year's fledglings. Black-crown night heron (*Nycticorax nycticorax*) were removed from the base of NS2 by predator management; however. NS2 had the second highest number of nests (n=50) versus STI which had 84 nests but fewer chicks (Table1).

Table 1. Summary of California least tern breeding activity at BCER during 2013. Data include the total number of nests per location; sum of eggs; number of nests that hatched (H) and nests that probably hatched (PH); the sum of chicks (includes actual chicks counted and hypothetical (PH) chicks); number of nests predated (P); nests abandoned (A); and, number of fledglings.

LOCATION	#NESTS	#EGGS	#NESTS H	#NESTS PH	#CHICKS	#NESTS P	#NESTS A	#FLEDGLINGS
South Tern Isl. (STI)*	84	124	25	7	50	13	37	1
Nest Site 1 (NS1)	20	29	0	0	0	20	0	0
Nest Site 2 (NS2)	50	80	23	22	69	1	4	34-66
Nest Site 3 (NS3)	3	3	0	0	0	3	0	0
BCER All	**157**	**236**	**48**	**29**	**119**	**37**	**41**	**35-67**

*Note: STI also had two nests with an unknown fate.

NS2 was the only site that had any 3-egg clutch nests (Table 2). Due to egg predation early in the season, NS1 had more 1-egg clutches than 2-egg clutches and NS3 only had 1-egg clutches.

Table 2. Breakdown of clutch size per nesting location on BCER during 2013.

LOCATION	1-EGG CLUTCH	2-EGG CLUTCH	3-EGG CLUTCH	EGG SUMS
South Tern Island	44	40	0	124
Nest Site 1	11	8	0	29
Nest Site 2	22	26	2	80
Nest Site 3	3	0	0	3
BCER All	**80**	**74**	**2**	**236**

Documented Predation

Documented, suspected, and possible predators on LETE are listed for each nest site in Table 3. A male northern harrier killed two adult LETE and may have taken numerous LETE and SNPL chicks during the season. According to a local birder (Steven Smith), a pair of northern harriers may have nested in the Huntington Beach wetlands which is located less than 15km south of BCER.

A red-tailed hawk was also strongly suspected of taking chicks from STI. Eggs were taken by gulls (*Larus ssp.*) and Corvids. Because American kestrel (*Falco sparverius*) and black-crowned night heron are each numerous at Bolsa Chica, they are always potential predators of LETE and SNPL chicks.

A total of 6 common ravens (*Corvus corax*), 5 American crows (*Corvus brachyrhynchos*), 12 black-crowned night heron, and 1 brown marsh rat (*Oryzomys palustris*) were removed by predator management. The rat was trapped near NS1 and translocated.

Table 3. Possible (PP), suspected (SP) and documented (DP) predators of California least tern at each location on BCER during 2013.

PREDATOR SPECIES	STI	NS1	NS2	NS3	OTHER
American crow	PP	PP		PP	
American kestrel	PP (chicks)			PP	
Black-crown night heron	PP (chicks)		PP (chicks)		
Common raven	PP	PP	PP	PP	
Corvid	DP-20 eggs	PP	DP-1 egg	S-3 eggs	
Gull		DP-29 eggs			
Northern harrier (male)	SP (chicks)			DP-1 adult	DP-1 adult
Red-tailed hawk	SP (chicks)				

Recommendations for the 2014 Season

To increase breeding success of LETE at Bolsa Chica, we recommend the following actions for 2014:

1. Continue to control vegetation on all nest sites.
2. Increase the number of hours per month of predator monitoring and management during and leading up to the nesting season.
3. Continue using decoy terns on NTI to encourage large terns to nest there rather than on NS1.
4. Haze or otherwise discourage gulls and other large seabirds from loafing on NS1 during the breeding season; however, presence of SNPL on NS1 may make this difficult.

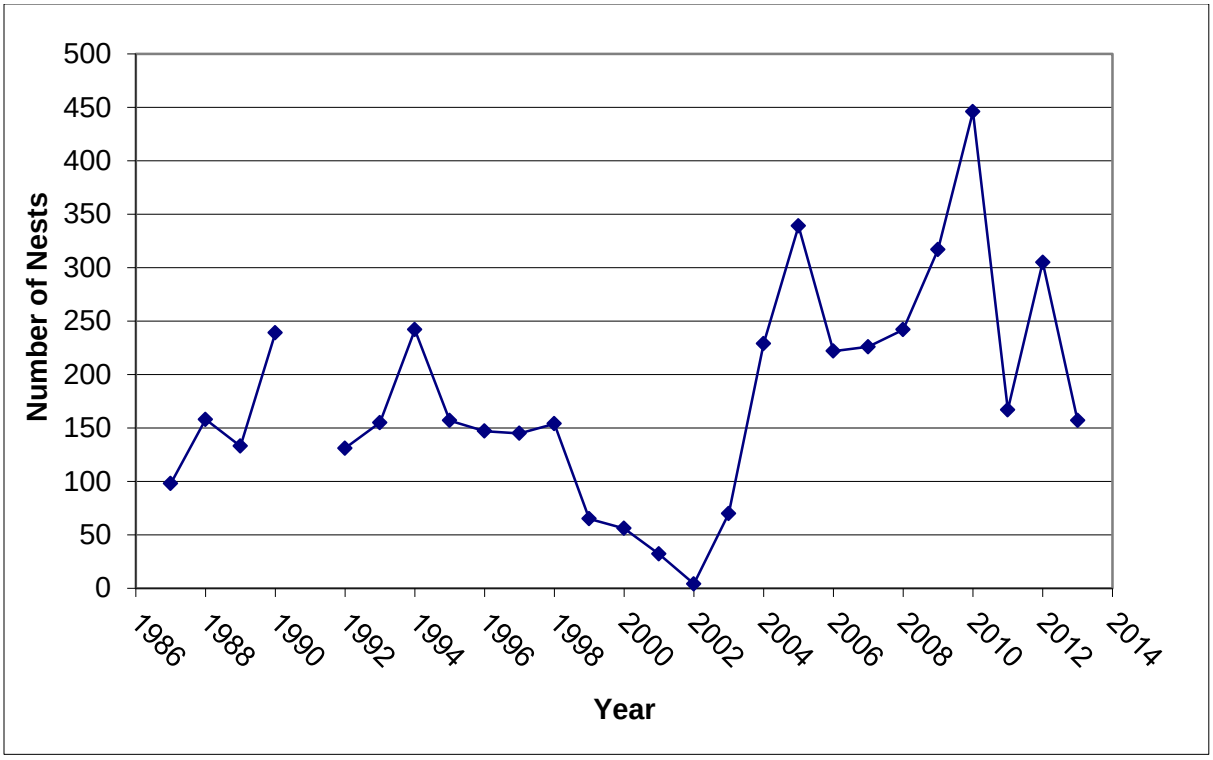

Figure 3. Annual California least tern nest totals at Bolsa Chica, 1986 to 2013 (no data for 1991).

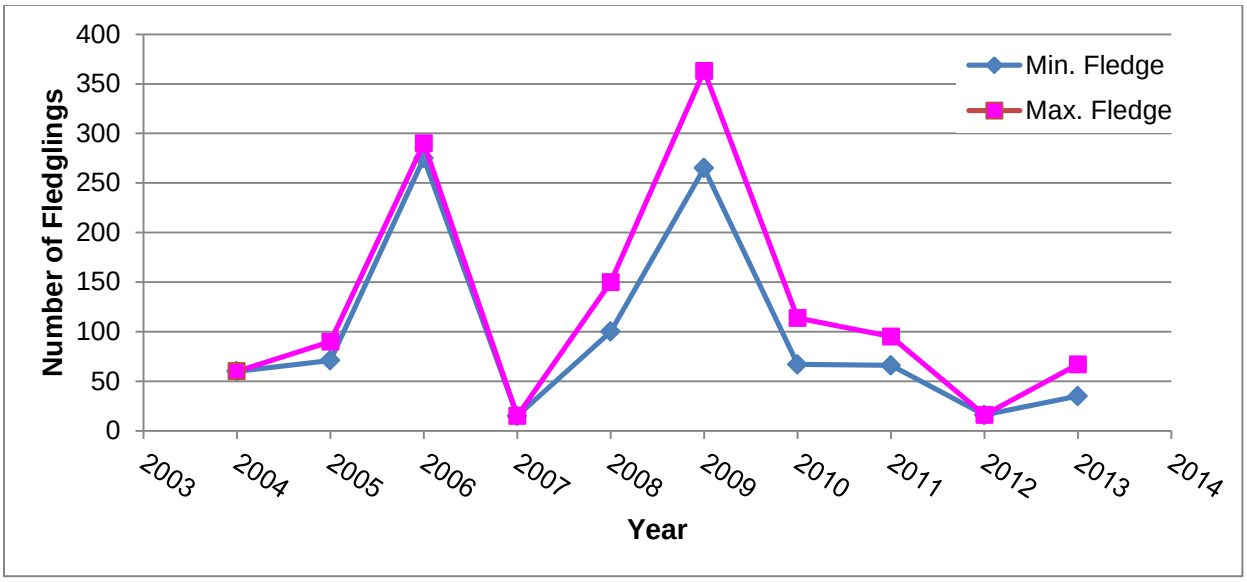

Figure 4. Annual minimum (blue diamonds) and maximum (pink squares) fledgling estimates for California least tern at Bolsa Chica, 2004 – 2013.

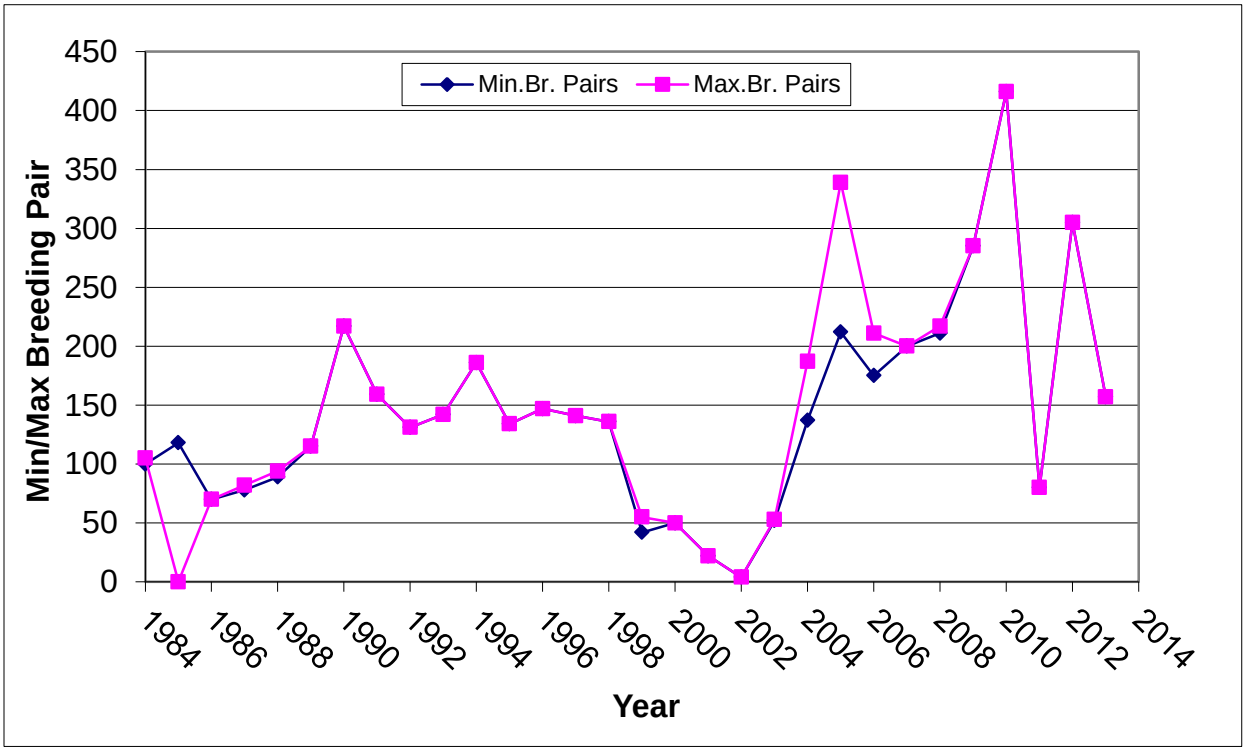

Figure 5. Annual minimum (blue diamonds) and maximum (pink squares) breeding pair estimates for California least tern at Bolsa Chica, 1984 – 2013.

California least tern with juvenile rock fish prey. Photo: S. Smith.

AKNOLWEDGEMENTS

The authors wish to express their gratitude to R. Griswold, C. Collins and G. Keller for their help with monitoring and W. Ross for performing predator management during 2013. We also thank the Eye On Nest Sites (EONS) volunteers who made observations of nesting activity on the northern end of NS1 and N. Doshi of the Bolsa Chica Conservancy who entered, summarized and shared all the EONS data. We are very grateful for the donation of fencing at Nest Sites 1 and 3 that was so generously donated by the Amigos de Bolsa Chica and the Bolsa Chica Conservancy.

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